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Descriptions of the Larva and Pupa of
Necydalis cavipennis LeConte
and the
Pupa of *Ortholeptura insignis* (Fall)
(Coleoptera: Cerambycidae)

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INTRODUCTION

On the basis of adult morphology the tribe Necydalini is currently included in the subfamily Lepturinae. The genus *Necydalis* is well developed in Asia, much less so in Europe; Gressitt (1961) gives a key to sixteen species, one of which, *N. major* Linnaeus, occurs also in Europe. In the Nearctic fauna we have *Necydalis* with six species and two subspecies, *N. mellita* (Say) being from southeastern Canada and the northeastern United States, the rest from the Pacific Coast eastward to the Rocky Mountains; and *Ulochaetes*, monotypic, from the Pacific Coast (Linsley, 1940).

Our genera do not reach the neotropics, but the stronghold of the tribe is actually Chile, with some 35 species in three genera; some kinds have long elytra. Two other genera occur in Brazil, one having *Rhathymoscelis haldemani* Thomson described from Mexico and recorded from Guatemala.

The nearctic species of *Necydalis*, with their long legs and elytra so short as to expose the wings, are strongly suggestive of ichneumonid wasps. The large, hairy, black and testaceous *Ulochaetes leoninus* Le Conte is well named the bumblebee longhorn; see Linsley, 1961, p. 40.

When the immature stages are examined, immediately there are problems in classification. Craighead (1923) gave the first descriptions of larvae, with a key to separate *U. leoninus* and three of the six nearctic species of *Necydalis*, and epitomized the pupa of *U. leoninus* in three lines. He remarked, "The larvae of this tribe show a strong and undoubted relationship to the Aseminae. This is illustrated in the tendency (in some species) of the dorsal margins of the epicranium to be slightly fused and in the short, robust, triangular mandible. In *Ulochaetes* it is shown by the velvety asperate pronotum and ampullae, and the two lateral impressions marking off the ambulatory ampullae, caused by splitting of the strong muscles from the posterior cuneal notch. The legs are weaker than in other Lepturinae and jointed as in the Aseminae." Duffy (1953) gave fuller descriptions of the larva and pupa of *Ulochaetes*. Of the former he wrote, "It is only with difficulty that this larva can be retained in the LEPTURINAE, possessing as it does many affinities towards the ASEMINAE, such as the non-tuberculate, asperate ampullae, the asperate pronotum and the protuberant gular sutures."; of the latter, "The pupa of this species, although not at all typical of the LEPTURINAE, does not show any marked affinities toward those of the ASEMINAE as is the case in the larval stage." The pupa of *Necydalis* is described for the first time in the following paper, and it fits Duffy's key to the Lepturinae even less well than does that of *Ulochaetes*.

If the immature stages of the south American genera and species prove not to fit well into either the Lepturinae or the Aseminae as now classified, it is possible that the adults should be restudied. In his 1960 monograph on the immature stages of Neotropical timber beetles Duffy recorded of *Necydalini*, "Unfortunately no neotropical material of this tribe was available." However, he was able to quote a number of host records from the literature, so this matter may be near solution. The ancient type of distribution, aberrant appearance of the adults, and discordant characters of the larvae and pupae may suggest a higher than tribal standing for the group, if supporting characters are found in the adults.

THE LARVA OF *NECYDALIS CAVIPENNIS*

Craighead gave a rather short description of the larva of *Necydalis cavipennis*, with figures of certain parts. A fuller description is offered here, and attention is drawn to discrepancies between his findings and mine.

In 1953 there appeared the first of Duffy's very fine regional works, "A monograph of the immature stages of British and imported timber beetles (Cer-

ambycidae)." The only example of the Necydalini included is *U. leoninus*, a nearctic species occasionally imported into Britain in timber. In his key to the subfamilies of cerambycid larvae he wrote (p. 66, footnote 1), "The genus *Ulochaetes*, possessing as it does many affinities toward the ASEMINAE, can only with difficulty be included in the LEPTURINAE as only the first character given in the key is applicable (see also p. 146)."

The larva of *N. cavipennis* on the other hand agrees well with his characters for the Lepturinae in the key to subfamilies *except* for the first one! The posterior emargination of the head is neither deep nor very shallow, though closer to the shallow or asemine type. In his key to the genera of Lepturinae known from Britain, it will trace to couplet 8 with all characters in agreement, but will run to the typical lepturines *Leptura* and *Strangalia* rather than to the necydaline *Ulochaetes*.

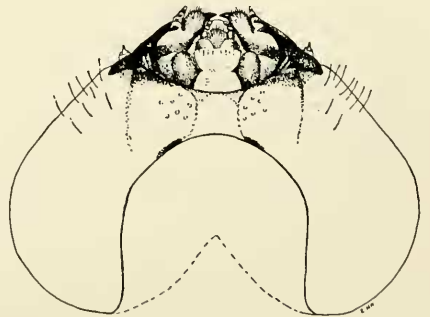
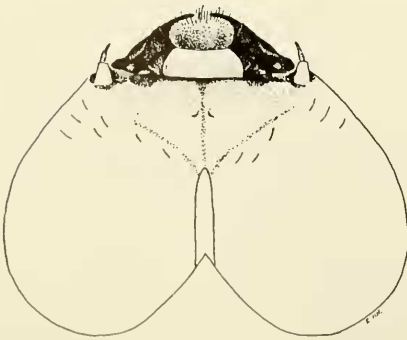
Craighead included *Necydalis* in his treatment of the Lepturinae (*loc. cit.*, p. 82), but in his own key to the subfamilies (p. 26) the larva traces to Aseminae, because in couplet 2 the choices are restricted to the fusion or separation of the epicranial halves behind the front (fig. 3). Thus one is not greatly surprised to find him state, in his discussion of the subfamily Aseminae, "In fact the Necydalini could be as well placed with the Aseminae as in the true Lepturinae."

Hardy and Preece (1927, p. 64) and Linsley (1940, p. 275) have given notes on the hosts and habits of the larva of *N. cavipennis*. My specimens were found in the damp, rotting heartwood of a log of tanbark oak, *Lithocarpus densiflorus* at Mill Valley, Marin County, California, 26 May, 1957. These and other rearings were published by me in 1959, page 43. Mature larvae were taken from their pupal cells, as were pupae with associated last larval skins; adults were reared, and subsequently examined by Dr. John Chemsak, who confirmed my identification.

MATURE LARVA (figs. 1, 2). Length 26 to 30 mm., maximum width at prothorax 6 mm. Form subcylindrical, depth of abdomen greater than its width (compare figs. 1 and 2), tapering slightly to fifth abdominal segment. Head (figs. 3, 4) about three-quarters as wide as prothorax, transverse, rather thick, nearly twice as wide as deep; one pair of ocelli, inconspicuous, laterad of antennae, lens rounded; six small setae present on the narrow epistoma. Antennae three-segmented, with large fleshy basal membrane (figs. 5, 6) into which first segment is commonly retracted; segment two slightly shorter, narrower and more tapering than one, with an inconspicuous short conical supplementary apical process (fig. 5); third segment small, less than twice as long as process of second, and bearing three apical setae; when not retracted, antennae (less basal membrane) are as long as maxillary palpi. Mandible short, triangular, stout, cutting edge obliquely truncate and not toothed dorsally near its base; outer side a little rugose basally, with transverse median arcuate



Figures 1-2. Larva of *Necydalis cavipennis*, dorsal and lateral views respectively. Length, 28 mm.



Figures 3-4. Larva of *Necydalis cavipennis*, dorsal and ventral views of head. (From Craighead).

carina, slightly sinuate, beginning at base of cutting edge; a single hair arises from near top of each rugose area; in outline, mandible closely resembles that of *Homaesthis emarginatus* (Say); a prionine, as figured by Craighead (1923, pl. I, fig. 10). Labrum with numerous setae along front margin and onto adjacent dorsal surface, one longer seta laterally near each hind angle on the median, more strongly sclerotized area, and a transverse line of smaller ones near base.

Hypostoma slightly narrower than long, with about fifteen well separated setae in inner anterior half; sutures nearly straight, ferruginous. Gula one-fifth longer than wide, half as wide as hypostoma, narrowest anteriorly; sutures slightly, irregularly raised, ferruginous. Maxillary palpi rather short and broad, first segment two-thirds as long as wide, third shorter than second and slightly tapered; lacinia broad, fleshy, rounded apically, densely setose. Labial palpi separated by twice their own width.

Prothorax weakly arcuate dorsally, nearly twice as broad as long, weakly sclerotized, with a transverse vaguely ferruginous band behind front margin. Pronotum seven-ninths as long as it is wide between lateral furrows, which are distinct in basal half; surface of lateral furrows and front margin dull, finely velvety with tiny golden spicules (see best when surface is dry and lighted from an angle); darkened band behind front margin shining, longitudinally rugose, sparsely setose across anterior darkened band. *Proeusternum*, presternum laterally in part, and sternellum transversely across middle, velvety spiculate with scattered setae (fig. 6); eusterna of meso- and meta-thoracic segments dull, sparsely velvety spiculate, their sternella shining, with irregular bead-like tubercles and a transverse median furrow. Mid-metanotum with small patch of tubercles, comparable to those of abdominal ampullae; in some cases a few tubercles are found on mid mesonotum. Legs rather small and weak, nearly as long as gula; unguiculus straight, stout, with basal seta on inner side.

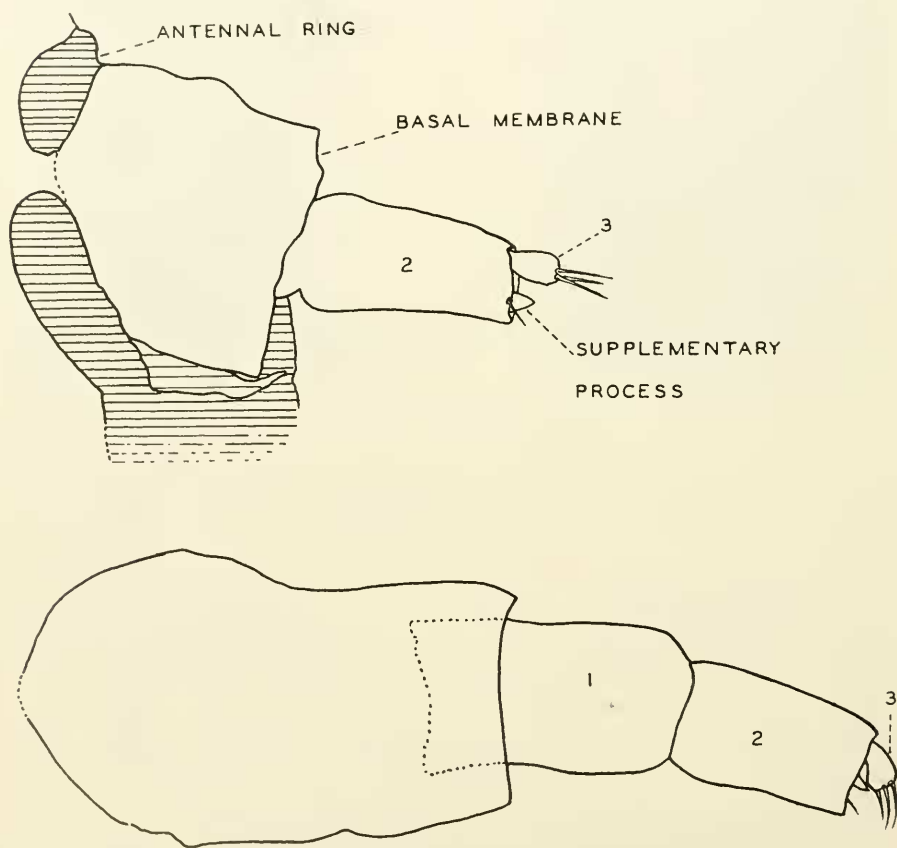
Abdomen with dorsal ampullae closely set with bead-like tubercles, arranged in definite transverse rows only on first segment; ampulla of first segment with a broad median longitudinal impression, segments two to five with progressively narrower and shallower impressions, ampulla of segment six not impressed; fine golden spicules on sides of and in transverse median line across ampullae. Tenth abdominal tergum simple at apex; anus terminal. Ampullae on first seven abdominal sterna, the ampullae progressively narrower and more rounded, first four each with a median transverse impression, all with bead-like tubercles. Each ventral ampulla encircled by an area of tiny golden spicules.

REMARKS. The larvae described above will trace to *N. cavipennis* in Craighead's key to the species (1923, p. 83), but differ from parts of the de-

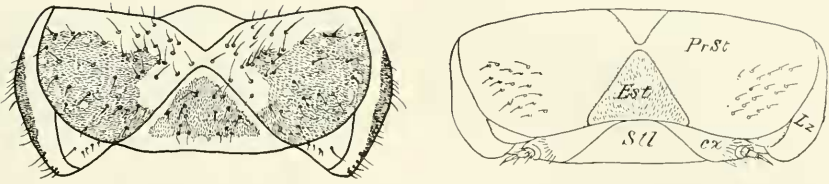
scription on page 84, and from figures on plate XXII as follows:

1. The second antennal segment is appreciably shorter than the first (fig. 6), not twice as long, as it was described by Craighead.

2. The front margin of the pronotum is dull, velvety spiculate (Craighead wrote, "Pronotum anteriorly glabrous, posteriorly rugose;..."). The mid-metanotum has a patch of bead-like tubercles, not mentioned by Craighead; this area is comparable to an abdominal ampulla and doubtless functions in the same manner. There are similar areas on the meso- and metasterna, also not mentioned by Craighead.



Figures 5-6. Larva of *Necydalis cavipennis*. Figure 5 shows the interrupted antennal ring, the partially contracted large basal membrane, and antennal segments 2 and 3. This is the view usually seen. Figure 6 shows the basal membrane fully extended, segment 1 extruded, segment 2 a little retracted and twisted in relation to figure 5.



Figures 7-8. Prothorax of larva of *Necydalis cavipennis*. Figure 7 shows extensive velvety-spiculate area on the presternum, with small smooth spots, and the setae on both the presternum and eusternum. Figure 8 shows prothorax as figured by Craighead.

3. Craighead's figure 9, plate XXII, shows a ventral view of the prothorax. The legend draws attention to the triangular, finely pubescent eusternum, which is differentiated in his drawing (fig. 8 of the present paper). However, in my material the presternum is in large part equally densely spiculate, as are also the epipleura (fig. 7). More significantly, the distribution of large setae on the presternum of my specimens differ considerably from that figured by Craighead, and he does not show any arising on the eusternum.

4. Craighead's figure 10 on plate XXII illustrates the dorsal ampulla of the third abdominal segment, with tubercles occupying a median transverse band; his figure shows the band of tubercles to be five-eighths the width of the ampulla. In my specimens the band extends completely across the ampulla, from margin to margin.

Since Craighead's description was based on a larva from California, from the same host plant as mine, it presumably was *N. cavipennis*. The differences noted may have resulted in part from the artist's interpretations, in part from a greater variation within the species than has been evident in my material.

It should be mentioned that there is confusion in some of the legends for Craighead's plate XI. The second sentence, starting "Note that the dorsal...", of the legend for figure 2, actually pertains to figure 1. Similarly, the second sentence of the legend for figure 4 applies rather to figure 3.

THE PUPA OF NECYDALIS CAVIPENNIS

The pupa of a species of *Necydalis* has not been described before. In Duffy's key to pupae of the subfamilies of Cerambycidae (*loc. cit.* pp. 86-88), that of *N. cavipennis* traces to couplet 3 because the head has spines, the prothorax has no lateral tubercles, and the prothorax projects beyond the coxae as a "T"-shaped process. His couplet 3 is as follows:

"3. Ninth abdominal segment either with a horizontal spine (fig. 65) or with excurved or parallel urogomphi (fig. 83). Tarsi each bearing one or a pair of setae (fig. 65). Hind tibiae with long, apical, tuberculate spurs (fig. 76). Labrum transverse, rectangular (fig. 65). Functional spiracles absent on sixth and seventh abdominal segments. [Femora always with apical setae (fig. 65). Head triangular and usually rather elongate. Clypeus usually with a deep impression and a row of setae across base (fig. 65)] 3. LEPTURINAE, ¹ p. 88

— Ninth abdominal segment usually simple but sometimes with strongly incurved urogomphi (figs. 111, 248). Tarsi nearly always without setae, but if setose (*Monochamus*) then antennae coiled. Hind tibiae never with long, apical, tuberculate spurs. Labrum seldom transverse, but if so never rectangular; usually triangular or cordate (fig. 286). Functional spiracles present on sixth or seventh abdominal segments (fig. 193)....4."

"1. The genus *Ulochaetes* can only with difficulty be included in the LEPTURINAE as only the first two characters given in the key are applicable (see also p. 145)."

The second choice leads via couplet 4 to the Aseminae, Cerambycinae, and Lamiinae.

The pupa of *N. cavipennis* agrees with only certain of the definitions in the first part of couplet 3. Taking the points as they are given: The ninth abdominal segment has a pair of excurved urogomphi. The tarsi lack setae. The hind tibiae (as well as the front and middle tibiae) have each a pair of rather short apical spurs, only slightly tuberculate. The labrum is virtually square, not transverse. There are functional spiracles on both the sixth and seventh abdominal segment. The femora have no apical setae. The head is triangular and rather elongate. The clypeus has no deep impression nor a row of setae across the base. Thus the pupa doesn't fit even as well as that of *U. leoninus*, the only necydaline considered by Duffy; yet neither is it in agreement with much of the second part of couplet 3.

In Duffy's key to the Lepturinae (*loc. cit.*, p. 88-89) it traces best to couplet 6, which contains the North American *Ulochaetes leoninus* (occasionally introduced into Britain in timber) in the first choice, and the British *Lep-tura* and *Strangalia* in the second. The pupa of *N. cavipennis* agrees better with that of *Ulochaetes*, but each spine on the abdominal tergites bears a sub-basal (not subapical) seta, which thus closely resembles the larval unguiculus. The tarsi lack setae, the tibial spurs are short, the femora are without setae, and the hind legs have the tarsi shorter than the tibiae.



Figures 9-10. Male pupa of *Necydalis cavipennis*, dorsal and ventral views respectively. Length, 22 mm.

PUPA (figs. 9, 10). Length 15 to 24 mm., width up to 7 mm. Head elongate, triangular, with faint transverse rugae; vertex visible from above, with four longer spines, one at each corner of an approximate quadrangle, and two or three irregularly placed smaller spines nearby; anteriorly, with a group of from two to six small spines of several sizes and irregular placement opposite base of each antenna; clypeus without setae. *Antennae* arcuate, extending to bases of hind coxae thence curved anteriorly for two segments, terminating adjacent to apices of hind tibiae. Eyes large but not prominent, not setose. Mandibles with a group of tiny setae on a small prominence at outer apical three-fifths; apex a sharp cone, angled slightly inward. *Labrum* almost square, slightly wider than long, apical half with median longitudinal impression, appearing almost bilobate; sometimes with a few tiny setae near sides of basal section, which may be slightly tumid medially.

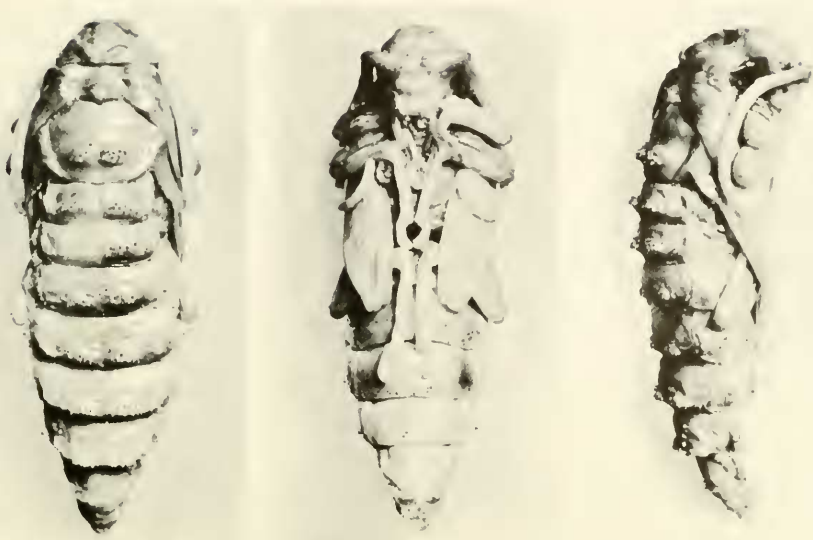
Pronotum tumid, broadly pyriform or oviform, slightly wider than long, widest just before middle, apex five-sevenths as wide as base; anterior angles small but distinct, hind angles not apparent, base broadly rounded; tumid area nearly circular, broadest anteriorly, extending from just before basal five-sevenths to apical two-sevenths; median line apparent, especially on posterior declivity of tumidity where sides of "valley" formed by it are transversely rugose; a patch of spines on each side of median line, starting at top of tumidity and extending more than half way to base of pronotum, each spine with a subbasal seta. *Scutellum* with a few minute setae. *Metanotum* with a few very small seta-bearing spines grouped on each side of median line slightly behind middle.

Abdomen with terga one to eight each having a scattering of small seta-bearing spines in an irregular group on each side of median line, those on terga one and two slightly behind middle, others nearer apices of terga. Eighth and ninth terga produced posteriorly in male but not in female pupa. Tenth tergum short, terminating in a pair of horizontal urogomphi, their apices curved outward, hooked, and strongly chitinized; urogomphi of male almost three times as long as dorsal length of tenth tergum, those of female less elongate. *Sterna* glabrous. Tenth sternum of male projecting behind eighth as a rectangular protuberance (fig. 10), twice as broad as long, tuberculate on each side at middle, divided on median line posteriorly and slightly bilobed; in female pupa sternum ten is represented by two small subcontiguous rounded bumps. *Pleura* glabrous. *Legs* glabrous; hind femora reaching to middle of third abdominal segment. Functional spiracles on first seven abdominal segments; peritreme oval, thin, not raised above general level of cuticle.

THE PUPA OF ORTHOLEPTURA INSIGNIS (FALL)

This is a typical lepturine pupa, tracing readily to Lepturinae in Duffy's key, and agreeing on all points. In his key to the British genera of the subfamily it runs to *Leptura*. Craighead described, but did not figure, the larva and pupa of the closely related *O. valida* LeConte; his description of the pupa is short and that of *O. insignis* (which has not been characterized or illustrated before) answers his description equally well.

Fall (1907, p. 251) described *O. insignis* as from "California, Monterey (Fuchs and Fenyes)." Before me are two pupae, one shown in the accompanying photographs (figs. 11, 12, 13); the other contains a beetle so nearly ready to emerge as to make identification simple. They are from the collection of the late F. E. Blaisdell, Sr., but the original label, "Monterey, June 30/01" is in the writing of Carl Fuchs. It is thus possible that they were taken at the same time as the original Fuchs material Fall had before him in 1907.



Figures 11-13. Female pupa of *Ortholeptura insignis*, dorsal, ventral, and lateral views. Length 25 mm.

PUPA (figs. 11, 12, 13). Length 22 to 25 mm., width 8 to 9 mm. *Head* with faint transverse rugae across front, and across vertex behind antennal bases; vertex barely visible in dorsal view of pupa; vertex with irregular group of ten or twelve stout setae on each prominence (one on each side of median line, midway between it and eyes), several setae in depression between prominences and antennal bases; five or six strong setae and one or two smaller ones on a protuberance above base of each antenna; clypeus with transverse arcuate row of six stout setae. *Antennae* glabrous, extending to base of second abdominal segment, curved, ending near apex of middle tibiae. Eyes bare. Mandibles with single seta at middle of outer face. Labrum nearly rectangular, a little more than twice as broad as long, glabrous.

Pronotum quadrate, margined laterally, a little wider than long, hind angles rounded; a few spines laterally at mid-point and near base. Front margin impressed at middle between two transverse protuberances which project backward (in the example at hand the area behind the protuberances is lunately depressed, but this is probably the result of damage after it was collected); protuberances impressed across their bases, each with eight or ten stout setae apically and a few more on summit of pronotum. There is a deeply impressed "V" with its point at middle of base of pronotum, its ends at middle, half way between middle of disk and sides, and bounding a broadly diamond-shaped transversely striated area which has several setae arising from

small tubercles; a line of about eight setae on a crested tumidity on each side of point of above mentioned "V." *Scutellum* rugose laterally near base, apical part tumid with group of about ten setae on each side of middle. *Metanotum* transversely rugose along mid-line, which has a tumidity on each side, preapically, tumidities each armed with twenty to twenty-five stout setae.

Abdomen with terga one to six each with paired tumidities, each tumidity having a posterior regular and an anterior less regular line of papillae, each papilla bearing a stout apical spinose seta; seventh tergum narrow, with sides converging posteriorly, rounded apically; eighth tergum only half as long as seventh, each with a scattering of setae; ninth tergum short, terminating in a pair of horizontally excurved urogomphi which are hooked and strongly sclerotized apically. Sterna three to six each with a few small setae about half way between mid-line and sides, seventh and eighth with setae more apical, fewer; ninth sternum with ten or twelve stronger setae on each side; tenth sternum with one or two small setae on the paired tubercles (female pupa). *Pleura* each with one or two seta-bearing papillae on a raised area. *Legs* with row of small setae near apex on outer face of each femur; hind tibiae each with paired small blunt apical spurs; tarsi a trifle shorter than tibiae, each tarsus with single seta near apex; hind femora reaching to middle of fourth abdominal segment. Functional *spiracles* present on first five abdominal segments; peritreme broadly oval, thin, barely raised above general level of cuticle.

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